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Magma sources during Gondwana breakup: chemistry and chronology of Cretaceous magmatism in Westland, New Zealand

Quinten H. A. van der Meer (1), Tod E. Waight (1), and James M. Scott (2)

(1) Copenhagen University, Department of Geosciences and Natural Resource Management, København, Denmark (quinten.vandermeer@geo.ku.dk), (2) Department of Geology, University of Otago, Dunedin 9054, New Zealand

Cretaceous-Paleogene rifting of the Eastern Gondwana margin thinned the continental crust of Zealandia and culminated in the opening of the Tasman Sea between Australia and New Zealand and the Southern Ocean, separating both from Antarctica. The Western Province of New Zealand consists of a succession of metasedimentary rocks intruded by Palaeozoic and Mesozoic granitoids that formed in an active margin setting through the Phanerozoic. Upon cessation of subduction, the earliest stages of extension (∼110-100 Ma) were expressed in the formation of metamorphic core complexes, followed by emplacement of granitoid plutons, the deposition of terrestrial Pororari Group sediments in extensional half-grabens across on- and offshore Westland, and the intrusion of mafic dikes from ∼90 Ma. These dikes are concentrated in the swarms of the Paparoa and Hohonu Ranges and were intruded prior to and simultaneous with volumetrically minor A-type plutonism at 82 Ma. The emplacement of mafic dikes and A-type plutonism at ∼82 Ma is significant as it coincides with the age of the oldest seafloor in the Tasman Sea, therefore it represents magmatism coincident with the initiation of seafloor spreading which continued until ∼53 Ma. New ^{40}Ar-^{39}Ar ages indicate that the intrusion of mafic dikes in basement lithologies both preceded and continued after the initial opening of the Tasman Sea, including an additional population of ages at ∼70 Ma. This indicates either a prolonged period of extension-related magmatism that continued >10 Ma after initial breakup, or two discrete episodes of magmatism during Tasman Sea spreading.

Volumetrically minor Cenozoic within-plate magmatism continued sporadically throughout the South Island and bears a characteristic HIMU (high time integrated U/Pb) signature. A detailed geochemistry and chronological study of Cretaceous mafic and felsic magmatism is currently in progress and aims to better understand the transition of magma sources from a long lived active continental margin through breakup to a passive setting, and to constrain the onset and evolution of the chemical characteristics of the magmas and their sources, including the origin of the distinctive HIMU signature.